SOLAR OBSERVATIONS

SOLAR RADIATION MEASUREMENTS DURING MAY, 1932

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For a description of instruments employed and their exposures, the reader is referred to the January, 1932, REVIEW, page 26.

Table 1 shows that solar radiation intensities averaged above the normal intensity for May at Washington and Madison, and slightly below at Lincoln.

Table 2 shows a deficiency in the total solar radiation received on a horizontal surface at Madison, Wis., Twin Falls, Idaho, and Gainesville and Miami, Fla.; an excess was received at all other stations, which was especially marked at New York and Chicago.

Skylight polarization measurements, obtained at Madison on six days give a mean of 60 per cent and a maximum of 66 per cent on the 28th. At Washington, measurements obtained on seven days give a mean of 54 per cent and a maximum of 59 per cent on the 3d. These are average values for May for both stations.

TABLE 1.—*Solar radiation intensities during May, 1932*

[Gram-calories per minute per square centimeter of normal surface]

Washington, D. C.

Date	Sun's zenith distance										
	8 a.m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	Noon
	75th mer. time	Air mass									Local mean solar time
		A. M.					P. M.				
	e.	5.0	4.0	3.0	2.0	[1] 1.0	2.0	3.0	4.0	5.0	e.
	mm.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mm.*
May 3	4.57		0.85	1.02	1.22	1.50					5.16
May 6	8.81					0.99					11.38
May 16	11.81			0.76							12.24
May 18	6.27					1.46	1.13				3.63
May 20	8.81				1.04	1.38					5.16
May 23	4.37					1.45	1.12				4.37
May 24	8.18	0.59	0.67	0.76	0.99	1.32	1.04				9.83
May 25	10.59				0.98	1.22					14.10
May 26	13.13				1.01	1.34	1.10				14.10
May 27	15.65				1.10	1.36					16.79
Means		(0.59)	(0.76)	0.85	1.04	1.33	1.10				
Departures		−0.05	+0.05	+0.03	+0.05	+0.04	+0.19				

TABLE 1.—*Solar radiation intensities during May, 1932*—Continued

Madison, Wis.

Date	Sun's zenith distance										
	8 a.m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	Noon
	75th mer. time	Air mass									Local mean solar time
		A. M.					P. M.				
	e.	5.0	4.0	3.0	2.0	[1] 1.0	2.0	3.0	4.0	5.0	e.
	mm.	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*
May 2	4.75			0.91	1.00						3.63
May 10	7.57					1.39					6.76
May 12	7.87					1.34					7.57
May 13	7.87				1.08						7.04
May 14	9.47			1.06		1.35					9.83
May 17	5.16				1.20						3.30
May 19	5.56			0.88	1.10	1.33					6.27
May 23	4.95					1.36	1.06	0.82			5.16
May 28	5.36				1.22	1.32					5.79
Means				0.95	1.12	1.35	(1.06)	(0.82)			
Departures				+0.01	+0.02	−0.01	+0-03	−0.07			

Lincoln, Nebr.

May 9	8.18	0.46	0.57								8.48
May 11	6.76			0.93	1.12	1.40	1.13	0.92	0.79	0.68	5.79
May 12	6.76	0.45	0.61	0.77	0.98	1.34	0.90				8.48
May 13	8.18				1.04	1.34					9.14
May 14	8.18		0.73	0.90	1.10	1.39	1.07	0.88	0.72		8.81
May 16	5.79		0.73	0.96	1.13	1.43					12.24
May 18	10.21						1.08	0.88	0.73		7.29
May 23	10.59			0.93	1.08	1.32					11.81
May 24	11.81					1.41	1.11	0.93	0.78		10.97
May 31	13.61						1.20	1.00	0.76		12.68
Means		(0.46)	0.66	0.90	1.08	1.38	1.08	0.92	0.76	(0.68)	
Departures		−0.19	−0.13	−0.03	−0.04	±0.00	−0.02	−0.01	−0.02	−0.04	

[1] Extrapolated.

Table 3 summarizes solar radiation measurements, I_y and I_r, obtained by means of the yellow and red glass filters described in the February, 1932, REVIEW, and values of the coefficient of atmospheric turbidity β derived therefrom. The turbidity values do not differ materially from those for April.

TABLE 2.—*Average daily totals of solar radiation (direct+diffuse) received on a horizontal surface*

Week beginning	Washington	Madison	Lincoln	Chicago	New York	Fresno	Pittsburgh	Fairbanks	Twin Falls	La Jolla	Gainesville	Miami	New Orleans
	Gram calories per square centimeter												
1932	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*
April 29	494	322	508	380	477	541	387	399	413	442	629	579	322
May 6	288	421	481	301	338	668	337	400	604	373	580	554	344
May 13	536	604	586	576	551	635	551	464	564	393	515	515	246
May 20	651	487	585	546	653	719	616	519	527	572	534	372	239
May 27	590	487	483	474	515	701	459	335	459	505	474	442	424
	Departures from weekly normals												
April 29	+34	−128	+17	+15	+13	−38	−7		−131	+24	+14	+33	
May 6	−158	−33	+21	−75	−31	+57	−69		+4	−47	−47	−17	
May 13	+73	+134	+68	+184	+173	+4	+114		−70	−43	−107	−49	
May 20	+154	+1	+30	+126	+250	+59	+133		−133	+102	−58	−147	
May 27	+74	−3	−24	+49	+104	+39	−5		−165	+33	−93	−41	
	Accumulated departures on May 29, 1932												
	+2,415	−987	−1,295	+5,964	+7,749	+2,562	+2,387		−4,753	+3,794		+2,485	

TABLE 3.—*Solar radiation measurements, and determinations of atmospheric turbidity factor, β. Washington, May, 1932*

Date and solar hour angle	Solar altitude, *h*.	Air mass, *m*.	I_m	I_y	I_n	β	Blueness of sky	Atmospheric dust particles per cubic centimeter	Polarization (per cent) and clouds
May 3	° ′		gr. cal.	gr. cal.	gr. cal.				
5:17 a	18-05	3.19	0.978	*0.741*	0.612	0.067		483	
5:11 a	19-15	3.02	1.000	.763	*.623*	.069			
4:50 a	22-43	2.59	1.101	*.834*	.677	.067			
4:46 a	23-29	2.49	1.120	*.847*	.691	.075			
4:19 a	28-45	2.08	1.217	.879	*.706*	.065			
4:15 a	29-31	2.03	1.225	*.883*	*.708*	.065	5		58.6
3:31 a	38-44	1.60	1.282	*.927*	.738	.087			
3:25 a	39-53	1.56	1.291	.933	*.745*	.075			
1:30 a	59-12	1.16	1.432	*.990*	.778	.078			
1:26 a	59-57	1.15	1.438	.990	*.778*	.075			
0:34 a	65-40	1.09	1.449	.997	*.772*	.075			
0:30 a	65-54	1.09	1.432	*.975*	.770	.078			
May 4									
3:34 a	38-18	1.62	1.180	------	.703	.120		840	
3:29 a	39-10	1.58	1.201	.887	*.705*	.120			
May 16									
5:20 a	19-36	2.96	.762	.612	*.510*	.145		966	
5:16 a	20-22	2.84	.791	------	.512	.135			
May 18									
0:56 p	67-07	1.09	1.434	------	.818	.110		483	
1:02 p	66-21	1.09	1.432	1.047	*.812*	.100			
2:14 p	55-14	1.22	1.386	*.982*	.774	.090			
2:18 p	54-20	1.24	1.354	.975	*.770*	.110			
3:18 p	43-10	1.46	1.271	.886	*.718*	.090			
3:24 p	42-02	1.49	1.258	*.886*	.700	.085			
4:16 p	32-08	1.88	1.157	*.844*	.685	.090			
4:20 p	31-16	1.92	1.131	.842	*.683*	.100	4		54.0
May 20									
2:15 a	55-49	1.21	1.251	*.890*	.716	.130		567	
2:10 a	56-38	1.20	1.250	.890	*.716*	.120			
0:34 a	70-20	1.06	1.340	.878	*.702*	.090			
0:28 a	70-42	1.06	1.328	*.876*	.700	.095			
2:04 p	57-50	1.18	1.310	*.926*	.730	.120			
2:08 p	57-18	1.19	1.296	.928	*.730*	.125			
May 23									
3:44 a	38-49	1.59	1.265	*.909*	.718	.080	4	309	58.0
3:38 a	40-00	1.56	1.267	.908	*.722*	.085			
3:26 a	42-26	1.48	1.280	.909	*.724*	.090			
3:21 a	43-24	1.45	1.301	*.916*	.726	.080			
2:54 a	48-30	1.33	1.329	*.937*	.747	.095			Ci.
2:48 a	49-46	1.30	1.336	.960	*.748*	.095			
2:32 a	52-34	1.26	1.364	*.965*	.747	.080			Ci.
2:14 a	56-02	1.20	1.388	*.965*	.758	.075			
0:36 a	70-11	1.06	1.433	*.965*	.742	.058			
0:25 a	70-58	1.06	1.388	.992	------	------			
0:09 a	71-38	1.05	1.434	------	.753	.068			
0:44 p	70-19	1.06	1.422	------	.769	.087			
0:52 p	69-22	1.07	1.433	.983	------	------			
1:08 p	67-22	1.09	1.413	------	.729	.040			
4:24 p	31-47	1.90	1.183	------	.685	.075			
4:30 p	30-50	1.94	1.146	.859	------				
May 24									
5:47 a	15-20	3.75	.694	------	.457	.105		588	
5:37 a	17-13	3.35	.720	.568	*.477*	.120			
5:30 a	18-33	3.12	.745	*.579*	.486	.120			
5:02 a	23-54	2:46	.854	*.650*	.535	.130			
4:54 a	25-33	2.31	.896	.678	*.556*	.125			
4:37 a	28-44	2.08	.971	------	.579	.110	5		46.9
3:43 a	39-47	1.56	1.105	------	.635	.125			
3:38 a	40-51	1.52	1.126	.807	------	------			
0:23 a	71-17	1.05	1.273	------	.745	.180			
May 25									
5:00 a	24-30	2.41	.863	------	.560	.145		890	
4:44 a	27-24	2.17	.930	.699	------	------	4		55.6
3:54 a	37-08	1.64	1.054	------	.624	.145			
3:49 a	38-11	1.62	1.060	.777	*.625*	.145			
3:32 a	41-24	1.51	1.080	.791	.633	.145			
3:29 a	42-13	1.49	1.092	------	.634	.145			
0:40 a	70-08	1.06	1.193	------	.646	.145			
0:36 a	70-34	1.06	1.202	.827	------	------			
May 26									
4:12 a	33-47	1.78	1.085	*.813*	.663	.135	4	292	55.9
4:08 a	34-29	1.76	1.090	.840	*.664*	.135			
3:08 a	46-11	1.39	1.222	.869	*.684*	.110			
3:04 a	46-57	1.37	1.224	*.872*	.685	.110			
3:12 p	45-32	1.38	1.226	------	.678	.105			
3:14 p	44-57	1.40	1.221	.860	------	------			
4:16 p	33-02	1.83	1.129	.810	*.638*	.085			
4:20 p	32-21	1.86	1.132	*.806*	.639	.080			
May 27									
4:22 a	31-53	1.88	1.093	.804	*.635*	.100	4	309	55.0
4:19 a	32-33	1.85	1.112	*.810*	.639	.090			
3:42 a	39-38	1.56	1.166	.838	*.661*	.105			

POSITIONS AND AREAS OF SUN SPOTS

[Communicated by Capt. J. F. Hellweg, Superintendent United States Naval Observatory. Data furnished by Naval Observatory, in cooperation with Harvard, Yerkes, Perkins, and Mount Wilson Observatories. The differences of longitude are measured from central meridian, positive west. The north latitudes are plus. Areas are corrected for foreshortening and are expressed in millionths of sun's visible hemisphere. The total area, including spots and groups, is given for each day in the last column]

Date	Eastern standard civil time		Heliographic			Area		Total area for each day
			Diff. long.	Longitude	Latitude	Spot	Group	
1932	*H*	*m*	°	°	°			
May 1 (Yerkes Observatory)			No spots					
May 2 (Naval Observatory)	10	14	No spots					
May 3 (Naval Observatory)	10	9	No spots					
May 4 (Naval Observatory)	11	14	No spots					
May 5 (Naval Observatory)	10	57	No spots					
May 6 (Naval Observatory)	11	58	No spots					
May 7 (Naval Observatory)	10	48	−83.0	260.5	−7.0	185		185
May 8 (Perkins Observatory)	16	56	−69.0	257.8	−7.5		45	45
May 9 (Mount Wilson)	13	25	−54.0	261.5	−8.0	127		127
May 10 (Yerkes Observatory)	10	43	−41.0	262.8	−7.5	148		148
May 11 (Mount Wilson)	14	0	−26.0	262.8	−8.0	106		106
May 12 (Yerkes Observatory)	12	29	−13.5	262.9	−7.6	116		116
May 13 (Naval Observatory)	13	27	0.0	262.7	−8.0	108		108
May 14 (Naval Observatory)	11	38	−60.0	180.4	+5.0		31	
			−36.0	214.4	+13.0		46	
			+13.0	263.4	−8.0	93		170
May 15 (Naval Observatory)	11	28	−46.0	191.3	+6.0		123	
			+26.0	263.3	−8.0	123		246
May 16 (Naval Observatory)	13	19	−73.0	150.0	+12.0		401	
			−29.0	194.0	+7.0		93	
			+41.0	264.0	−8.0		123	617
May 17 (Perkins Observatory)	10	55	−58.5	152.6	+12.0		124	
			−11.0	200.1	+10.0		98	
			+53.0	264.1	−4.0	45		267
May 18 (Naval Observatory)	10	18	−47.0	151.3	+11.0		401	
			−7.0	191.3	+8.0		31	
			0.0	198.3	+6.0	123		
			+67.0	265.3	−8.0		45	570
May 19 (Naval Observatory)	12	18	−33.0	150.9	+11.0		370	
			+9.0	192.9	+8.0		25	
			+15.0	198.9	+6.0	123		518
May 20 (Naval Observatory)	10	41	−76.0	95.6	+4.0	401		
			−21.0	150.6	+10.0		370	
			+28.0	199.6	+6.0	123		894
May 21 (Naval Observatory)	10	23	−64.0	94.5	+4.0	401		
			−8.0	150.5	+10.0		370	
			+41.0	199.5	+6.0	123		894
May 22 (Naval Observatory)	11	51	−50.0	94.5	+4.0	309		
			+7.0	151.5	+10.0		309	
			+56.0	200.5	+6.0	93		711
May 23 (Naval Observatory)	11	44	−37.0	94.9	+4.0	309		
			+19.0	150.9	+10.0		247	
			+68.0	199.9	+6.0	62		618
May 24 (Naval Observatory)	10	50	−24.0	94.6	+4.0	278		
			+31.0	149.6	+10.0		216	494
May 25 (Naval Observatory)	10	57	−10.0	95.3	+4.0	247		
			+46.0	151.3	+10.0		154	401
May 26 (Naval Observatory)	11	4	+3.0	95.0	+4.0	247		
			+60.0	152.0	+10.0		93	340
May 27 (Naval Observatory)	10	8	+17.0	96.3	+4.0	216		
			+72.0	151.3	+10.0		77	293
May 28 (Naval Observatory)	10	29	+31.0	96.8	+4.0	216		216
May 29 (Naval Observatory)	11	47	+45.0	96.9	+4.0	216		216
May 30 (Naval Observatory)	10	32	+58.0	97.3	+4.0	216		216
May 31 (Naval Observatory)	10	29	+70.0	96.1	+4.0	185		185
Mean daily area for May								281

PROVISIONAL SUN-SPOT RELATIVE NUMBERS FOR MAY, 1932

(Dependent alone on observations at Zurich and its station at Arosa)

[Data furnished through the courtesy of Prof. W. Brunner, University of Zurich, Switzerland]

May, 1932	Relative numbers	May, 1932	Relative numbers	May, 1932	Relative numbers
1	8	11	9	21	30
2	0	12	9	22	*a* 31
3	0	13	8	23	31
4	0	14	Eac 25	24	34
5	0	15	36	25	23
6	0	16	d 35	26	a 22
7	d 8	17	41	27	18
8	----------	18	40	28	17
9	14	19	a 27	29	----------
10	8	20	d 38	30	10
				31	8

Mean: 29 days=18.0

a=Passage of an average-sized group through the central meridian.
b=Passage of a large group or spot through the central meridian.
c=New formation of a center of activity: E, on the eastern part of the sun's disk; W, on the western part; M, in the central zone.
d=Entrance of a large or average-sized center of activity on the east limb.